

STEREO Flight Software Status

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Baseline Deliverables

- Flight products
 - C&DH software
 - G&C flight computer software
 - AIE software
- GSE products
 - C&DH testbed software
 - G&C testbed software
 - Spacecraft emulator software (for instrument support)
 - Hardware diagnostic software

Software Development Planning

- Co-locate developers with hardware system implementers
- Establish central repository for software documentation and code
- Use tools to integrate requirements, architecture, design, implementation, R/QA, test, and documentation
 - control requirements
 - keep documents up-to-date with “as-built” software
 - help collect software R/QA information automatically
 - identify impacts of proposed requirements changes
- Provide standard utility functions for data storage and communications on all flight processors

Trade Studies

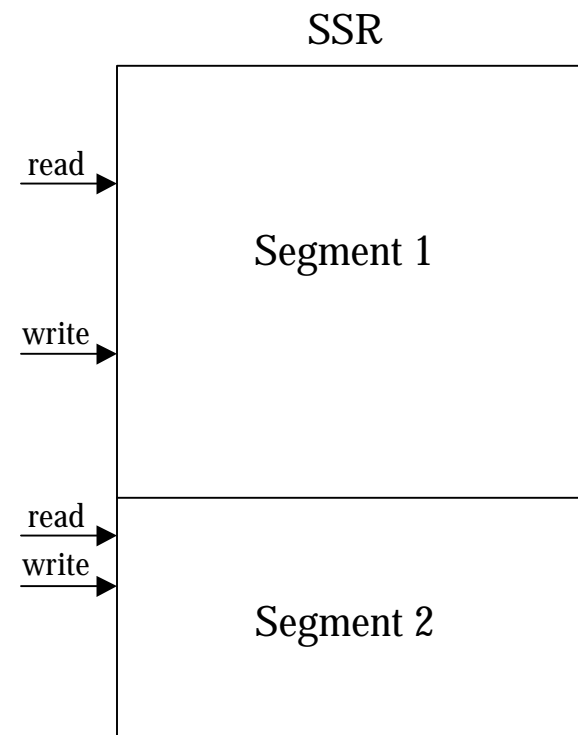
- Variable length packets
 - John Hayes is writing software to benchmark on the Mongoose
 - Impact on TIMED mission ops software reuse needs to be evaluated
- G&C computer make / buy
 - Dan Rodriguez is coordinating
 - If “buy”, we will study operating system / development tool options
- SSR management automation - discussion follows

SSR Management

- TIMED baseline: very manual
 - Each SSR block holds 242 bytes of user data
 - Each SSR cluster holds 512 blocks, and is marked “good” or “bad”
 - Each SSR contains 2501 clusters
 - Each SSR is divided into 2 segments with programmable sizes
 - Each SSR segment has a write pointer and a read pointer
 - write pointer is number of block to be written next
 - read pointer is number of block to be read next
 - SSR operations are controlled by low level commands
 - set map of good and bad clusters
 - set read / write pointers
 - start / stop read / write operations

TIMED SSR Operations

- SSR operations are “tape-like”
 - read, write pointers are like tape positions
 - operations are sequential
 - blocks are like fixed-length tape records
- Mission operations has to manage cluster maps, segments, pointers, etc.
- Record / playback / replay scheduling requires continuing manual effort
- Non-intuitive user interface requires significant training for new operators



Proposed SSR Management

Goal: minimize manual MOPS management of SSR

- MOPS operator functions
 - set priorities of multiple playback data sets
 - start / stop data passes
 - monitor data playback; debug problems

- C&DH / MOPS software functions
 - monitor availability of downlink
 - when link is available, dump SSR using priorities set by MOPS
 - retransmit data as necessary to complete dataset on ground
 - delete data from SSR when received successfully on ground

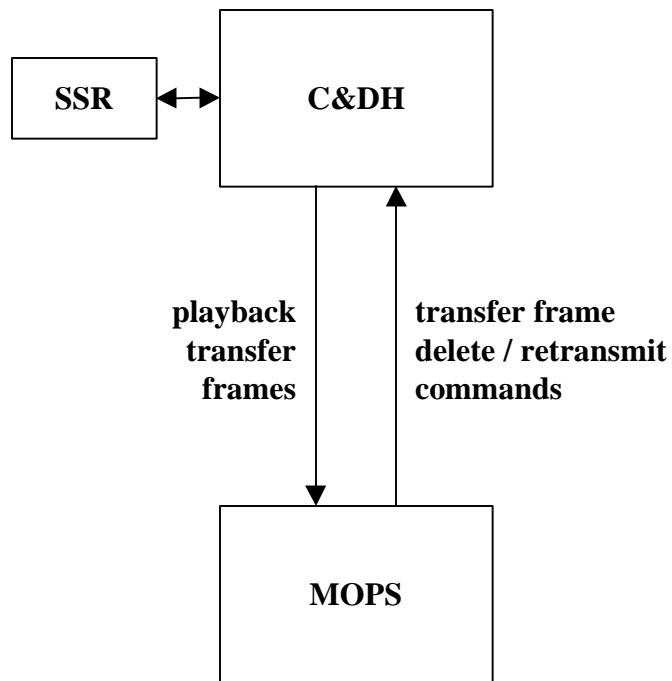
Nominal Data Pass Operations

- Establish contact
- Initiate command load uplink
- Downlink starts automatically according to pre-programmed priorities, for example:
 - G&C anomaly data
 - Engineering anomaly data
 - Instrument data
 - Nominal engineering data
- Operators can override downlink priorities in real time

Downlink Display Mock-up

| Recorded Data Status | | | |
|--|--|--|---|
| Rate: 50.0 kbytes / sec. | | | |
| Data Remaining | | | |
| <div>Start <input checked="" type="radio"/></div> <div>Stop <input type="radio"/></div> <div>Active</div> <div><div></div></div> <div>5.2 of 8.2 kBytes</div> <div>G&C anomalies</div> | <div>Start <input checked="" type="radio"/></div> <div>Stop <input type="radio"/></div> <div>Active</div> <div><div></div></div> <div>0.0 of 0.0 kBytes</div> <div>Engineering anomalies</div> | <div>Start <input checked="" type="radio"/></div> <div>Stop <input type="radio"/></div> <div>Active</div> <div><div></div></div> <div>107.4 of 107.4 MBytes</div> <div>Instrument data</div> | <div>Start <input checked="" type="radio"/></div> <div>Stop <input type="radio"/></div> <div>Inactive</div> <div><div></div></div> <div>10.2 of 10.2 kBytes</div> <div>Engineering hsk.</div> |
| Real time hsk. update (sec.) | | | <div>1 <input checked="" type="radio"/></div> <div>10 <input type="radio"/></div> <div>1000 <input type="radio"/></div> <div>Off <input type="radio"/></div> |

SSR Management Concept



C&DH software

- Transmits frames as indicated by priority
- Keeps frames until commanded to delete them
- Retransmits or deletes frames as commanded

MOPS software

- Bookkeeps frames received or missed
- Sends delete commands for frames received
- Sends retransmit commands for frames missed

SSR Management Issues

- Delete / retransmit protocol details
 - minimize uplink messages due to constrained bandwidth
 - add query commands to determine SSR statistics
- Could we use protocols already developed?
 - GSFC is demonstrating a low level protocol to do file transfers
 - JPL is implementing Internet protocols optimized for space
- Is a protocol like this safe and effective for Stereo?
 - Assess whether they meet Stereo's requirements
 - assess impact on C&DH loading and bandwidth overhead
 - assess impact on C&DH and MOPS software reusability
 - estimate savings in Mission Operations costs